Accelerator Systems Division Highlights for the Week Ending April 12, 2002

ASD/LBNL: Front End Systems

The front end beam commissioning is underway with all operations this week focused on the commissioning of the beam diagnostics and RF systems. The first beam through the MEBT was achieved last Thursday, April 4 at 18:26 hours (see Figure 1) on the first shot. With the quadrupole magnets set at their nominal values, and all steerers turned off, a peak current of 7.5 mA was immediately observed on the beam stop. This week we have tested the system with up to 30 mA of beam and a pulse width up to 100 microseconds. Preliminary assessments indicate that even without optimized tuning, the beam is well centered on the MEBT axis and that the overall transmission is very high.

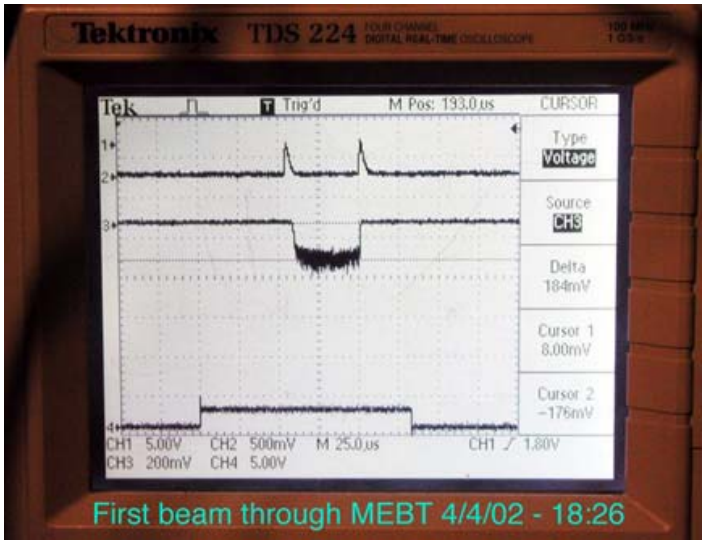


Figure 1: Scope trace of the first beam through the MEBT on April 4, 2002.

The following summarizes the progress and status.

Beam

To support the calibration and checkout of the beam diagnostics, a beam at 15 mA, 25 microseconds, 1 – 10 Hz has been established. All beam measurement data are being archived into EPICS once a second. The beam has been very reliable and the ability to produce beam essentially on demand has been demonstrated. The choice of very low duty factor is due to requirements imposed by the wire scanners. Low duty factor operation also serves to minimize radiation levels and risk of beam damage until the beamline is properly tuned.

Beam Instrumentation

All BPMs are online and well integrated into the EPICS control system. The two BCMs are also working properly and seen by EPICS. They however still require rebooting from time to time.

The wire scanners work correctly in the LabView embedded system that is part of the processing electronics. These systems are still being cleaned up, but appear ready to support the physics runs scheduled to begin next week. Integration with the EPICS system is still underway.

We have also supported a first attempt at measuring beam profiles with the laser 'wire' which has also been very successful. It has not yet been calibrated against the conventional wire. This effort is in support of future SNS activities and the system is not part of the baseline diagnostics for the MEBT. Therefore it has not been integrated with the front-end systems or with EPICS.

RF Systems

All LLRF systems have been installed and have been used to operate their respective cavities. Systems testing is progressing well and we expect to run the cavities with beam soon. All high power systems are ready to go and the rebuncher cavities have been conditioned to full power.

We have had many visitors this week, approximately 14 in all. This included a visit from Mike Hechler and Paul Gibson, who worked with Berkeley staff to refine details of the handover, as well as numerous experts from the diagnostics team. In particular, we want to acknowledge the effort and help from all collaborators from Oak Ridge, BNL and LANL who have delivered their diagnostics systems, and came to make them work at the integrated test facility at Berkeley.

ASD/LANL: Warm Linac

We have satisfactorily completed high-power site acceptance tests of the eight 550-kW, 805-MHz SNS circulators at LANL. (WBS 1.4.1.1)

LANL staff were again at Titan this week to continue acceptance tests on the first 805-MHz, 5-MW klystron transmitter. Considerable progress was made, but the tests are incomplete. We hope to finish next week with the extended high-voltage tests. (WBS 1.4.1.1)

In preparation for the higher power (> 1 MW) tests on the 402.5-MHz SNS klystron at LANL, compensated voltage dividers have been installed in the transmitter and the prototype high-voltage converter modulator. We are reviewing calibrations. In addition, we prepared to perform a new wire test on the HVCM prior to powering the klystron. A new load assembly was built in addition to a wire design and fabrication. All the safety analyses, procedures, reviews, and approvals are in place. (WBS 1.4.1.2)

The revised final RF controls reference line design was documented and sent to ASD for review and concurrence. (WBS 1.4.1.3)

LANL and ORNL staff are at GSI this week to prepare and begin copper plating operations on DTL Tanks 1 and 2. The baths were prepared, and used on GSI hardware, which will improve quality of the plating when SNS tanks go in next week. (WBS 1.4.2.2)

Considerable progress was made on the DTL resonant control system water skids (Fig. 1). The vendor, AVANTech, is proceeding on schedule. The building in which the water skid frame is located was built specifically for us to perform our testing and to act as a clean room away from any manufacturing equipment. We plant to travel to AVANTech next week to complete our functionality acceptance testing.

The last drift tubes for DTL Tank 3 were delivered to LANL. These drift tubes contain EMDs so they were mapped and tested at LANL before being installed and aligned in the linac. The bead pull hardware has been moved to the assembly hall, and all the software has been updated and checked. ORNL collaborators, Yoon Kang and Julius Fazekas, were at LANL to participate. (WBS 1.4.2.7)

We revised the CCL accelerator structure specification, to incorporate a bridge coupler design improvement recommended by ACCEL. (WBS 1.4.4.2)

The diagnostics team returned from LBNL after supporting successful first operation of the MEBT BPM and wire scanner diagnostics. (WBS 1.4.5.3)

We submitted PCR LI 02 024 to define scope of work and the scope being transferred to ORNL for the transition, warm and water-cooling regions of the SRF linac. The net result is to transfer $429K of funding to ASD. (WBS 1.4.6.1)

Fig. 1: Resonant control water skid manufacturing.

ASD/JLAB: Cold Linac

Installation, alignment and lockdown of the inner cryomodule components inside the vacuum vessel are complete. Hookup and leak checking of the supply process piping and supply beam pipe and ion pump is complete and the supply end ion pump now supports beam line vacuum. The return end turbo pump has been removed for assembly of the return end can with the vacuum vessel. Final fitting of the return end can is well advanced.

The Installation Design Package for the CHL Compressor Room has been released to SNS for construction.

The report of the review committee on the test program for the Prototype Cryomodule has been received. The committee generally supported the program as presented, but provided a number of useful suggestions for improvement.

SNS conducted an audit of the JLab QA/QC program as it applies to SNS. The audit reported no findings, three useful suggestions for further improvements and a commendation for the application of electronic travelers and logs for production data.

The 1 MW RF test stand continues to operate in support of Fundamental Power Coupler (FPC) processing.

ASD/BNL: Ring

In support of commissioning the MEBT system, Roger Connolly, Sheng Peng, and Craig Dawson were at Berkeley this week to help with MEBT diagnostics and diagnostic controls.

Ken Rust and Paul Holik were at BNL this week to meet with our engineers to review power supply and magnet buss issues.

Yuri Eidelman joined the SNS/BNL Controls Group.

Videoconference with ASD this week on Ring dipole high field power supply. Specs and SOW are being reviewed by all parties. Package to DCP this week or next.

HEBT "Y" box vacuum chambers; 4 received from vendor. They are being set-up for laser tracking inspection

Advised that our vendor (VARIAN) has shipped a 1st article turbo pump station to BNL.

Fabrication drawings for the welding fixture for the 21cm quad vacuum chamber are complete.

Dipole shimming: automation of the measuring station was finished last week. Magnet calibration using the new automated drive system is complete and results look very good, in that measurements are within the 10E-04 range. The calibration dipole is being changed-out to resume production measurements and shimming.

Magnetic measurement of the reworked sextupole (21CS26) (#2) corrector magnet was finished last week. Analysis is complete and the magnet accepted by our Physics Group. The vendor, Techni-Coil, will be given the go-ahead to start production.

21Q40 quad 2nd article – this magnet has been surveyed on the test stand. Magnetic measurements for acceptance testing were started this week.

Two prototype low field power supplies arrived form Danfysik late last week for pre-acceptance testing at BNL. Arrangements are being made for ASD personnel to assist with these tests.

BNL sponsored an "open house" for all bidders interested in the SNS Extraction Kicker Power Supply System (PFN modules). Vendor turnout was good.

Diagnostic cabling info was submitted to ORNL, as requested.

Ten new APPs have been submitted to ASD.

Received a PCR from ASD on scope transfer related to the linac and extraction beam dump vacuum windows (passive). We are in support of this transfer and currently working on the scope and cost details.

Received and approved ASD's Design Change Notice that identifies the Ring Collimator aperture shape changes that have been agreed to between ASD and BNL.

Budker Institute of Nuclear Physics (30Q44/58) - coil winding is underway; one coil wound and to be potted this week. Winding of a second coil will start this week. At BINP's request, we will share with them the methods and procedures for brazing stainless steel fittings to copper coils. Bottleneck is in getting BNL supplied tools and fittings through Russian Customs.

A second lot of eight (8) 27CDM30 corrector magnets arrived this week from Danfysik. Production total on hand is ~50%.

Controls

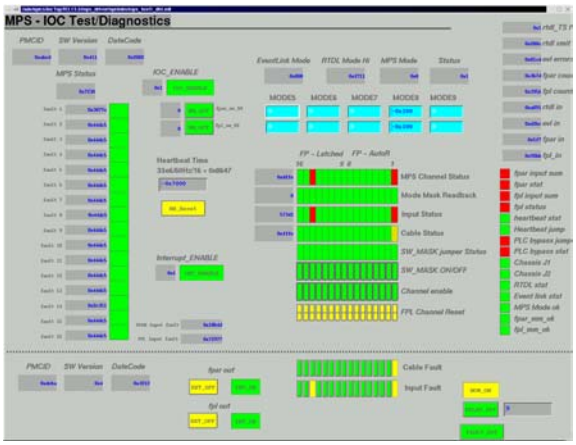
Susan Joseph joined the controls team this week. She will act as a linac controls system installation coordinator.

Ernest Williams participated remotely in setting up the archiver and the emittance measuring software for use during the Berkeley MEBT runs. Eric Bjorklund journeyed to Berkeley to assist with the implementation of the timing system for the MEBT beam run there. A small version of the SNS timing system is being installed there. It will provide all the gates and triggers for the RF system and diagnostics. We have received all timing system backbone hardware that provides the fiber optic RTDL, Event Link, and MPS signal distribution. The hardware is being set up and tested in the RATS building.

At LANL a sequence for klystron conditioning which monitors the klystron vacuum and saturation was developed. This should be tested next week.

Work continues on the Ion Source test stand controls at ORNL. A test environment for checking out the high voltage power supplies has been set up. Software is installed for checking out a compact spectrometer that will be used to look at the ion source discharge (through an optical fiber placed against the ion source vacuum chamber window.) Gas flow rates have been measured through the mass flow controller that will be used for the hydrogen gas on the hot spare.

Five MPS boards are complete. Two have been extensively tested. One system will be shipped to LANL next week and one to BNL when the remaining chassis are received. Shown below is the chassis with LEDs showing the same status as the EPICS control panel. On the bottom of the control panel are the controls for the MPS IO driver board. The driver for the Machine Protection System is almost complete and is now being tested.



A meeting was held at the 4.5 K cold box vendor's site to review progress on the construction of the equipment and discuss interfaces between the vendor, JLab and SNS. Most of the valves and other mechanical components have been mounted on the valve plate. Several subassemblies are ready for installation. Most of the instrumentation has been received. Relocation of the SNS control system cabinet to accommodate some process piping changes was discussed. It was determined that the control system cabinet should stay in its original location. The vendor

provided copies of the hardwired interlock logic drawings for our review and comment. The vendor also provided information on their control system equipment racks so that we procure matching racks.

Proposals for talks at the upcoming EPICS Collaboration Meeting in Berlin have been submitted and accepted. Talks are scheduled on the topics "pciRecord support", "Cross-compiler work for VXWorks objects running Linux", and "Interrupt latency and VXWorks task tuning".

Installation

Accelerator Physics

Stuart Henderson, Slava Danilov, and Sarah Cousineau attended the ICFA high intensity beam workshop at FNL, and presented 3 talks.

The orbit correction, orbit difference and x/y correlator application programs were built in the SNS simulated control room, converted to use the LBNL naming convention, and run monitoring live values from the initial MEBT commissioning taking place at LBNL. Presently only passive readback processing is done, but active setting of values is planned. It is hoped that we will be able to test these applications from Oak Ridge, avoiding a trip to LBNL.

Operations

Revised the ASD Spares Master list and sent it out to Group Leaders for approval.

Began work on the ASD “Readiness Plan Of Action”. We hope for submission to DOE prior to the DOE Review.

Worked on integrating the “Commissioning Program”. The plan is at XFD for completion of their sections, we hope for submission to DOE prior to the DOE Review.

Worked on the ASD Schedule.

Participated in discussions with XFD on the TPS, related to seismic events.

Worked on Ion Source Radiation Safety preparations with the Radiation Safety Committee. We hope to class the Ion Source as a Radiation Generating Device, not an accelerator under the ORNL SBMS Guidelines.

Reviewed PPS drawings

Worked with the SNS DCC on IMAN Folder structure mapping WbS to group-subgroups

Began work on the DTL Tank 3 Safety Basis Document

Completed two draft procedures for the Operations Procedures Manual related to Front End Operation and Generalized PPS Sweep Procedures

Ion Source Group

John Thomason from ISIS visited us. In his seminar he showed the current status of the ISIS ion source and outlined the development program they will follow to meet the ESS requirements. In addition John Thomason agreed to collaborate with us on the testing of a bias-free emittance analysis, as their current method is similar to ours.

The ion source has been equipped with an RF shield.

Paul Gibson visited LBNL to work out the details of the Front-End disassembly as well as the spares list.

On April 12, Robert Welton gave a seminar as a part of the Plasma Science Seminar Series sponsored by the UT Electrical Engineering Department. He discussed the Spallation Neutron Source as an overview as well as the ion source development.

RF Group

People are back after spending 2 weeks at Titan assisting with transmitter acceptance tests. On April 9th & 10th a schedule for transmitter deliveries was worked out with the intent to get Titan back on track.

3-402.5 transmitters delivered to ORNL week of June 9th
3-402.5 transmitters delivered to ORNL week of July 14th
1-805 transmitter delivered to ORNL week of July 14th
2-402.5 transmitters delivered to ORNL week of Aug. 18th
2-805 transmitters delivered to ORNL week of Aug. 18th.
1-402.5 transmitter delivered to ORNL week of Sept. 15th
3-805 transmitters delivered to ORNL week of Sept. 15th
2-805 transmitters delivered to ORNL week of Sept. 20th.

The week of April 8th the second of the not up to snuff Marconi tubes was tested, Joe Bradley from LANL witnessed. A report should follow this week.

LANL is moving forward on the LLRF system a note from Don Rej describes the status and implementation.

Completed cable list and database entry for HVCM cables. Modified JHA and SOP for HVCM operation in SNS facility. Modified ACL document to include QA recommendations.

Mechanical Group

Measurements on the HEBT 12Q45 quadrupole continue.

We are proceeding with manufacture and assembly of the Ring water-cooled copper Buss.

Review and updating of the vacuum labor estimates for site installation and RAT's support activities was completed for the SCL, HEBT, Ring and RTBT.

An investigation of leasing options for vacuum pumping and leak test stations needed to support the field installation of the cryo system was started. This option is being pursed to overcome potential schedule and cost constraints resulting from the advancement in the installation schedule for this system.

Re-testing of the injection beam dump flight tube was completed and the unit is now ready for installation. Cleaning of the extraction and Linac flight tube embedment assemblies prior to leak testing will commence next week before welding of the extension pipes.

A representative for LANL conducted the receiving inspection per ACL (Acceptance Criteria Listing) for DTL vacuum equipment shipped directly to RATS. This detailed inspection was necessary as a result of earlier non-compliant shipments from one particular vendor. SNS was unable to support this activity due to other priorities.

Accelerator equipment received this week included a further quantity of ion pumps and vacuum valves for the DTL/ CCL installation.

Testing of the first article RGA was delay until next week due to more urgent tasks.

Relocation of vacuum group personnel to the high bay area, due to limited office space, was completed.
The identification of equipment requiring routine calibration as commenced.

A safety walk down of vacuum area was completed and the need for additional signage for fire extinguisher stations identified together with the necessity to mark and maintain clear walkways and emergency egress routes.

Cryogenics Group

The supply line second 80' section is welded and ready for insertion into the pipe chase. The warm gas piping and conduit is assembled and ready for insertion. The return transfer line is 80% welded and should be ready for insertion by 2/17/02.

Transfer line: work continues on the medium beta supply modules. We continue to install the tooling for the return transfer line modules.

Beam Dump flight tubes: The tooling has arrived and we are cutting and weld prepping the piping.

Electrical Systems Group

The main ring dipole power supply procurement specifications were reviewed by the group members in a videoconference with BNL on 4/8/02. The specification was very well written and only a few suggestions were made.

Ken Rust visited BNL 4/9-4/11/02 to observe corrector power supply 1st article qualification tests and tests of the completed extraction kicker power supply prototype. He attended a pre-bid conference at BNL for proposed manufacturers of the production extractor kicker power supplies.

BNL is finalizing acceptance test plans for the prototype injection power supply and will schedule a test at the vendor, IE Power, soon.

Paul Holik visited BNL on 4/11/02 to coordinate the interface between the 1/2 cell Buss work supplied by BNL and the Tunnel Buss work supplied by ORNL.

The division held a videoconference with LANL on 4/10/02 to finalize plans for racks, cables and their associated documentation. The scope of procuring the cables and racks will be transferred to ORNL. The Electrical Engineering Group will provide rack and cable ordering assistance as required for all ASD groups. Dave Olsen has asked the Electrical Engineering Group to provide an estimate of the cost for the entire linac of the cables, racks and rack preparation in support of the PCR transferring scope from LANL to ORNL.

All racks and cables for the linac power supplies through the entire DTL have been ordered and received. All ac cables, panel boards and cable trays through DTL3 have been ordered - most of these components have been delivered.

Survey and Alignment Group

Beam Diagnostics Group

LANL Beam Diagnostics Progress Report:

BPM pickups: Modifications to the CCL BPM drawings are in checking. Modifications to the SCL BPM drawings are in progress. The two DTL tank 3 BPMs were turned over to the DTL mechanical team for installation. Vendor fabrication continues on the other eight DTL BPMs.

BPM electronics: John Power and Matt Stettler traveled to LBL this week to support the FES tests. Initial results from tests with beam look great.

WS actuators: Vendor fabrication continues on the prototype 3" and 6" DTL&CCL actuators. Work continues at JLab to test and qualify the SCL actuator and beam box. We put a hold on the SCL beam box drawing modifications while the details are being ironed out on the modifications to the design for the laser profile monitor. Initial results from tests with beam look great.

WS electronics: Chris Rose and Wynn Christensen traveled to LBL this week to support the FES tests. Initial results from tests with beam look great.

D-plate: Final detailing continues. We reviewed Princeton Scientifics' plans to fabricate the D-plate harps, and gave them the go-ahead to proceed with fabrication.

Cabling: Work continued on the diagnostics cable plant, rack layout, and block diagrams.

BNL Beam Diagnostics Progress Report:

General: Group member's submitted cabling information to ORNL

1.5.7.1 BPM: Work continues on Ring and RTBT electronics conceptual design, investigating not only the possibility of switching the LO in the AFE to permit digitizing either 400MHz or base-band BPM signals from all PUEs, but also of looking at the excited signal of the tune system (see below) At the request of AP, we are beginning the investigation of using BPMs as clearing electrodes.

1.5.7.2 IPM: Work continues on prototype test of luminescence monitor in the AGS Ring. All parts are fabricated, and installation will take place next week

1.5.7.3 BLM: Both the new design and old design are now functional. A decision must now be made as to which design to use. A request to have a videoconference to discuss this subject has been made.

1.5.7.4 BCM: The rev 2-art work has been completed and reviewed. The work will start to fabricate the new board. Craig Dawson visited LBNL and took part in the commissioning efforts in support of both the BCM and the LPM. Testing went well. The BCM unit is working, and the software has been upgraded to include two-channel operation. Drawings have been submitted to LANL for shroud resonance analysis.

1.5.7.5 Tune: Transfer function measurement simulations continue The possibility of providing an additional input to the BPM electronics to permit direct processing of the beam response at 50MHz during beam transfer function measurements.

1.5.7.6a Carbon Wire Scanner: A repair kit (carbon wire, springs, adhesive,...) was put together and shipped to Berkeley. Refurbishment of the spare wire scanner is in progress.

1.5.7.6b Laser Wire Scanner: Dedicated beam time for 200MeV Linac laser wire measurements is scheduled for next week. Roger Connolly, Craig Dawson, and Sheng Peng of the BNL Controls group were at Berkeley for the successful commissioning of the MEBT laser wire.

ORNL Beam Diagnostics Progress Report:

The MEBT diagnostics are commissioned with beam. They are performing very well. Craig completed the results of his transfer function measurements of the MEBT BPM's, which is in agreement with Bob Shafer's. He is in a process of writing a Tech-note on that. Craig is also working on the wire scanner e/m calculations. Wim Blokland traveled to Berkeley to help in commissioning diagnostic software and provided analysis routines to the commissioners. He wrote a 2-Channel BCM analysis program, worked with Wynn from LANL and Dave Purcell to get wire scanners tested, debugged and added features (e.g. analysis results, scaling and so on). Wim added a high-level analysis program to the Laser wire NAD. Saeed spent the week at LBNL commissioning the diagnostics. Dave built a number of EPICS diagnostic screens to provide the analyzed data to the users. Dave, Ernest and Delphy worked on a diagnostic data Archive Engine for the MEBT. Their data storage is available to the commissioners. Tom spent the Monday at LBNL organizing the diagnostic system integration. Our thanks to all partner lab's engineers and experts, they have done a wonderful job of supporting the MEBT diagnostic commissioning.